

Pneumococcal Serotyping in Indiana

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In February 2000, a seven-valent **pneumococcal conjugate vaccine (PCV7)** was licensed for use in infants and young children less than five years of age. Pneumococcal illness, caused by the bacterium *Streptococcus pneumoniae*, is a leading cause of serious illness among infants worldwide and has been the most frequent cause of pneumonia, bacteremia, sinusitis, and acute otitis media (AOM). In the United States, prior to the licensure of the vaccine, *S. pneumoniae* caused approximately 17,000 cases/year of invasive disease among children less than five years of age including 700 cases of meningitis and 200 deaths.

Knowledge of the distribution of pneumococcal serotypes is fundamental to evaluating the potential impact of a pneumococcal vaccine. Currently, 90 serotypes of *S. pneumoniae* have been identified on the basis of antigenic differences in their capsular polysaccharides. The majority of serotypes cause serious disease, yet a limited number of serotypes cause the majority of invasive pneumococcal infections. In the United States, the seven most common serotypes isolated from blood or CSF of children less than 6 years of age account for 80% of infections. Those seven (4, 6B, 9V, 14, 18C, 19F and 23F) are the serotypes included in the currently licensed pneumococcal conjugate vaccine. According to the 2002 National Immunization Survey Data, 40% of Indiana's two-year-old children have received 3 or more doses of PCV7. Recent licensure (2000) and shortages of PCV7 have limited the coverage rate for this vaccine.

The Indiana State Department of Health Special Reference Bacteriology Laboratory began serotyping invasive isolates in children less than five years of age in January of 2002. As of October 31, 2003, 47 isolates have been serotyped. Of those 47, 21 were in cases occurring in 2002 (out of a total of 117 total cases reported in the less than 5 year old age group) and 26 (out of 53 cases reported thus far in 2003) occurred in 2003. Of those 47, 15 (32%) were of serotypes that are contained in the vaccine. Of those 15 cases, 2 had received one dose of vaccine. One of these 2 cases, one was 3 years of age when infected and had received vaccine after 15 months of age, which would be considered appropriately immunized. The other vaccinated case was 10 months of age at the time of infection, but had received only one dose of vaccine. Infants should receive their third dose of PCV7 when they are 6 months of age. The isolate identified in both of these cases was 6B. See Table 1 for the frequency of isolates that were of serotypes contained in the vaccine.

**Table 1. Frequency of *S. pneumoniae* isolates of vaccine serotype by Age Group
Indiana, January 2002- October 2003**

| Age | Serotype 4 | Serotype 6B | Serotype 9V | Serotype 14 | Serotype 18C | Serotype 19F | Serotype 23F |
|--------------|---------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|
| < year | 1 | 1* | 0 | 2 | 1 | 2*** | 0 |
| 1 year | 0 | 1 | 0 | 0 | 2*** | 0 | 0 |
| 2years | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 3years | 1 | 1** | 0 | 1 | 1 | 0 | 0 |
| 4years | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Total | 2 | 4 | 0 | 3 | 4 | 2 | 0 |

* a ten-month-old with one dose of vaccine at 2 months of age

** a three-year-old with 1 dose of vaccine after 15 months of age

*** unknown vaccine history in one of the two cases noted for 18C and 19F

Thirty-two additional isolates submitted to the ISDH Laboratory were found to be non-vaccine serotypes. The frequency of each non-vaccine serotype is found in Table 2.

**Table 2. Frequency of *S. pneumoniae* isolates of non-vaccine serotype
Indiana, January 2002- October 2003**

| Serotype | Frequency |
|--|--|
| 6A | 8 |
| 9A | 3 |
| 15 | 3 |
| 33F | 3 |
| 19A | 2 |
| 7F, 11A, 12B, 12F, 15C, 22F, 23A, 33 | 1 isolate for each of the serotypes |
| Other Non Vaccine Types (NVT); specific serotype not identified. | 5 |
| Total | 32 |

The Respiratory Branch at Centers for Disease Control and Prevention (CDC) is tracking invasive pneumococcal cases that are considered to be vaccine failures. The CDC will verify the serotype identification obtained by the ISDH Laboratory, as well as record host conditions that may increase the risk of severe pneumococcal disease, and monitor for vaccine lots that may be less effective. The ISDH sends all isolates meeting specific criteria to the CDC for this vaccine failure study project. **Therefore, it is very important that all laboratories submit invasive pneumococcal isolates collected from infants less than five years of age to the ISDH Special Reference Bacteriology Laboratory.** The ISDH will provide a report upon request for each isolate submitted. If laboratories have questions about submission of specimens, they may call the laboratory at 317-233-8040.

In conclusion, cases for which isolates have been submitted are either 1) a non-vaccine serotype (17 of these 32 cases had received at least one dose of vaccine) and thus, not likely to be prevented by vaccination, or 2) an isolate of a vaccine type which has been obtained from an infant who was not vaccinated, with the exception noted earlier of the two cases that had received one dose of vaccine each. Only one of those two cases had been vaccinated according to a recommended schedule. This data is very encouraging, particularly in light of the PCV7 shortages that have occurred within the first 2-3 years following licensure of the vaccine. As two-year-old pneumococcal vaccination coverage increases from the 40% rate noted in 2002, incidence of disease will be decreased. More data and more isolates are needed to further monitor the effectiveness of the vaccine and complete the vaccine failure project at the Respiratory Branch at CDC.
